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OPTICAL DISC AND PLAYBACK DEVICE FOR THE SAME

[Hikari Disuku Oyobi Sono Saisei Sochi]

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Specification

1. Title of the invention

Optical disc and playback device for the same

2. Patent Claims

1. An optical disc characterized by the facts that a first information signal track is formed on either plane of a first unlaminated disc by recording, in the form of pits, information signals in a spiral fashion from inner circumferential to outer circumferential portions thereof along a specified first direction around the central axis of said unlaminated disc, that a second information signal track is formed on either plane of a second unlaminated disc by recording, in the form of pits, information signals in a spiral fashion from outer circumferential to inner circumferential portions thereof along the opposite direction of the aforementioned first direction around the central axis of said unlaminated disc, and that said first unlaminated disc & second unlaminated disc are mutually pasted in a state where the plane of the aforementioned first unlaminated disc on which the aforementioned first information signal track has been formed (hereafter referred to as the "first recording plane") and the plane of the aforementioned second unlaminated disc on which the aforementioned second information signal track has been formed (hereafter referred to as the "second recording plane") are being configured as mutually adjacent inner members.

2. An optical disc characterized, with regard to the optical disc specified in Claim 1, by the fact that the final recording position of information signals on the aforementioned first recording plane and the initial recording position of information signals on the aforementioned second recording plane virtually coincide with one another in terms of dimensions along the radial direction.

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[1] Numbers in the margin indicate pagination in the foreign text.

3. An optical disc playback device characterized, with regard to an optical disc playback device in possession of an optical disc constituted by recording a first information signal track on either plane of the first recording plane thereof by recording, in the form of pits, information signals in a spiral fashion from inner circumferential to outer circumferential portions thereof along a specified first direction around the central axis thereof, by forming a second information signal track on the second recording plane thereof by recording, in the form of pits, information signals in a spiral fashion from outer circumferential to inner circumferential portions thereof along the opposite direction of the aforementioned first direction around the central axis thereof, and by pasting the aforementioned first & second recording planes as mutually adjacent inner members, a disc drive unit designed to retain & rotate said optical disc along a certain specified direction, a first optical head designed to play back the information signals recorded onto the first recording plane of the aforementioned optical disc, a second optical head designed to play back the information signals recorded onto the second recording plane of the aforementioned optical disc, and a mobilization mechanism designed to mobilize, in mutually independent fashions, said first & second optical /2 heads along the radial direction of the aforementioned optical disc,

By the fact that, on an occasion where the information signals recorded on the first recording plane of the aforementioned optical disc are played back by the aforementioned first optical head, the aforementioned second optical head is mobilized in advance, namely prior to the playback of the information signal recorded onto the final recording position on said first plane, to the initial recording position of information signals on the second recording plane of the aforementioned optical disc by the aforementioned mobilization mechanism.

4. A optical disc playback device characterized, with regard to the optical disc playback device specified in Claim 3, by the facts that the aforementioned optical disc possesses a preliminarily recorded lead-out signal on the outer circumferential side of the final recording position of information signals on the aforementioned first recording plane and that the playback of information signals recorded on the second recording plane of said optical disc by the

aforementioned second optical head is initialized upon the detection, by the aforementioned first optical head, of said lead-out signal on the first recording plane of said optical disc.

3. Detailed explanation of the invention

(Industrial application fields)

The present invention concerns an optical disc playback device, and in particular, it concerns an optical disc and an optical disc playback device each capable of invoking playback actions of both sides of said optical disc without flip-flopping the optical disc outfitted on an optical disc playback device and of invoking, without entailing a time loss, continuous playback actions at the time of switching the playback actions of the first & second playback actions of said optical disc.

(Prior art)

As far as optical disc playback devices known in the prior art {e.g., one for playing back sets of video & sound information recorded on a laser vision disc (hereafter abbreviated as the "LD") provided as an optical disc} are concerned, the LD is outfitted within the optical disc playback device, and in a case where the first plane (side 1) of said optical disc is first played back and where the second plane (side 2) of said optical disc is then played back, it is necessary to remove the LD from the optical disc playback device once and, after manually flip-flopping the LD, to outfit said disc within the optical disc playback device once again, due to which cumbersome actions of ejecting, flip-flopping, & reloading the LD are unavoidable. Incidentally, a device related to this type of format is mentioned in Japanese Patent Application Publication Kokai No. Sho 58[1983]-114354 Gazette, for example.

As an optical disc, furthermore, Japanese Patent Application Publication Kokai No. Sho 60[1985]-111353 Gazette notes an optical disc wherein a first optical disc plane is constituted, as in

the prior art, in the morphology of a spiral track along the counterclockwise direction from inner circumferential to outer circumferential sides thereof, wherein a second optical disc plane is constituted, in contrast with the first plane of the aforementioned optical disc, in the morphology of a spiral track along the clockwise direction from inner circumferential to outer circumferential sides thereof, and wherein the first & second planes of the optical disc can be continuously recorded and/or played back in a state where the optical disc is being driven & rotated along a certain specified direction. Generally speaking, however, two types of LD disc morphologies are known, and since the rotation frequency can indeed be said to be invariable in terms of CAV (contant angular velocity), it may seem that both sides of the optical disc can be played back without entailing special problems according to the proposed embodiment; in terms of CLV (constant linear velocity), however, the rotation frequency of the optical disc varies, due to the invariable linear velocity, as the optical head becomes mobilized from inner circumferential to outer circumferential sides of the optical disc {1,800 rpm on the inner circumference & 600 rpm on the outer circumference (60-min. playback position)}; for this reason, a time for executing a certain rotation frequency control is necessary with regard to this previously proposed embodiment even if the optical disc rotating direction is invariable, and since this time serves as a loss time, it is difficult to continuously play back both sides. In other words, according to this embodiment proposed under tension [sic], the optical disc rotation frequency is 600 rpm at a stage where the playback action along the spiral track on the first optical disc plane has been completed, and in a case where the second plane is then played back from the initial position, it is necessary to return the rotation frequency of the optical disc to 1,800 rpm, and a certain time is accordingly required for executing this rotation frequency control.

(Problems to be solved by the invention)

Continuous double-sided playback actions of CLV discs are not particularly taken into consideration according to the aforementioned technique of the prior art, and in a case where an

attempt is thereby made to invoke continuous double-sided playback actions of CLV discs, the time for controlling & compensating for the rotation frequency differential between the inner & outer circumferences of the optical disc (approximately 5 ~ 8 sec.) is unavoidable as a loss time, which is problematic in that continuous double-sided playback actions become impossible. /3

The objective of the present invention is to provide, regardless of optical disc morphologies, namely of the pervasion of a CAV or CLV disc, a format for an optical disc capable of invoking continuous double-sided (first & second planes) playback actions of said optical disc without entailing a loss time as well as an optical disc playback device for playing back said optical disc.

(Mechanism for solving the problems)

In order to achieve the aforementioned objective, the present invention mandates, as a recording format for information signals to be recorded onto an optical disc, a format whereby said signals are recorded onto the first plane of the optical disc (plane corresponding to side 1) according, for example, to a counterclockwise spiral track morphology from inner toward outer circumferences thereof and onto the second plane of the optical disc (plane corresponding to side 2) according to a spiral track morphology from a position coinciding virtually with the final information signal recording position on the first plane toward the inner circumference thereof along the direction opposite of that on the first plane, namely clockwise.

The optical disc playback device for outfitting & playing back the aforementioned disc, furthermore, is provided by configuring mutually independent optical heads in relation to the first & second planes of said optical disc and by mobilizing in advance, namely prior to the playback of the information signal recorded onto the final recording position on said first plane on an occasion where the information signals recorded on the first recording plane of the optical disc are played back by the first optical head, the aforementioned second optical head to the initial recording position of information signals on the second recording plane of the optical disc.

(Functions)

In other words, since the format for recording information signals onto an optical disc hereby proposed involves, in relation to the first plane of the optical disc (plane corresponding to side 1), a counterclockwise spiral track morphology from inner toward outer circumferences thereof and, in relation to the second plane of the optical disc (plane corresponding to side 2), a clockwise spiral track morphology from outer toward inner circumferences thereof, it becomes possible, in a case where the optical disc is rotated & driven along a certain direction, to play back the first & second planes of the optical disc along the same rotating direction, and in the case of a CLV disc, furthermore, since the final information signal recording position on the first plane of the optical disc coincides virtually with the initial information signal recording position on the second plane of the same, their respective rotation frequencies also become identical. In a case where the optical disc playback device for outfitting & playing back the aforementioned optical disc is provided by configuring mutually independent optical heads in relation to the first & second planes of said optical disc, by playing back the first plane of said optical disc in a state where the position of said first optical head for playing back the first plane is being controlled, and by controlling & mobilizing, prior to the completion of the playback of the first plane, the second optical head for playing back the second plane of the optical disc to the initial information signal recording position on the second plane, therefore, it becomes possible, since the playback of the second plane of the optical disc by the second optical head becomes initialized at a point in time where the playback completion signal (lead-out signal) on the first plane has been detected by the first optical head for playing back the first plane of the optical disc, to invoke continuous playback actions of the first & second planes of the CLV disc without virtually entailing a loss time.

(Application examples)

In the following, an application example of the present invention will be explained with reference to figures.

Figures 1 are diagrams which show plane views of the information signal track morphologies of the optical disc of an application example of the present invention, whereas Figure 2 is a block diagram which shows an optical disc playback device for playing back the optical disc shown in Figure 1, whereas Figure 3 is a demonstrational diagram provided for explaining the optical disc rotation frequencies of a case where the first & second planes of the optical disc shown in Figure 1 are played back.

In Figures 1 & Figures 2, (1) is an optical disc, whereas (2) is an unlaminated disc in possession of the information signal track unit (2a) of the first plane (side 1) of the optical disc (1), whereas (3) is an unlaminated disc in possession of the information signal track unit (3a) of the second plane (side 2) of the optical disc (1); in other words, the optical disc (1) is constituted by mutually pasting the unlaminated discs (2) & (3). Moreover, (10) is a disc drive unit for retaining, rotating, & driving the optical disc (1) and is constituted by the disc motor (11), turntable (12), center adaptor (13), clamper (14), rotation frequency detection unit (15), etc. Moreover, (20) is a first optical head, whereas (30) is a second optical head, whereas (50) is a system control unit, whereas (51) is a disc motor drive circuit, whereas (52) is a laser drive circuit, whereas (53) is a focus tracking control circuit, whereas (54) is a detection signal processing circuit, whereas (55) is a switch circuit, whereas (56) is a playback signal processing circuit, whereas (57) is an address information processing circuit, whereas (100) is an optical disc playback device. /4

Next, actions will be explained.

In other words, as far as the respective morphologies of the information signal track units (2a) & (3a) of the unlaminated discs (2) & (3) constituting the optical disc (1) are concerned, the information signal track unit (2a) of the unlaminated disc (2), on which the information signals of the first plane of the optical disc (1) (plane corresponding to side 1) have been recorded, is constituted, as Figure 1 (a) indicates, according to a counterclockwise spiral track morphology from inner toward outer circumferences thereof in a case where the information signal track unit (2a) side is viewed as the upper plane. The goal of playing back the information signal track unit (2a) with

the beam spot (22) emitted from the first optical head (20) indicated by the dotted line in the figure can therefore be achieved by rotating the unlaminated disc (2) along the direction of the arrow A in the figure (clockwise).

Figure 1 (b), furthermore, shows the morphology of a case where the information signal track unit (3a) of the unlaminated disc (3) on which information signals of the second plane of the optical disc (1) (plane corresponding to side 2) have been recorded prevails as an upper plane, where the information signal track unit (3a) is constituted according to a clockwise spiral track morphology from outer toward inner circumferences thereof. The optical disc (1) is hereby constituted by mutually pasting the unlaminated discs (2) & (3) in a state where their respective information signal track units (2a) & (3a) are being configured on the interior side, and therefore, the morphology of the information signal track unit (3a) in a case where the unlaminated disc (2) of the optical disc (1) prevails as the lower member {state shown in Figure 1 (a)} and where the unlaminated disc (3) is viewed from above coincides with the constitution shown in Figure 1 (c). The goal of playing back the information signal track unit (3a) with the beam spot (32) emitted from the second optical head (30) indicated by the unbroken line in the figure can be realized by rotating the unlaminated disc (3) along the direction of the arrow B in the figure (clockwise). In other words, in a case where the respective information signal track units (2a) & (3a) of the unlaminated discs (2) & (3) constituting the optical disc (1) are played back with mutually independent first & second optical heads (20) & (30), playback actions can be invoked by rotating the optical disc (1) along one direction (clockwise). As far as the present application example is concerned, furthermore, the radial dimension R1 of the outermost circumferential information signal track (2b) of the unlaminated disc (2) shown in Figure 1 (a) is designed to virtually coincide with the radial dimension R2 of the initial information signal track (3b) of the unlaminated disc (3) shown in Figure 1 (c) (R1 = R2), and therefore, even in a case where the optical disc (1) is of the CLV disc morphology, the rotation frequency of the final information signal track position (2b) of the unlaminated disc (2) bearing the final information signal of the first plane (side 1) of the optical disc

(1) (N1) becomes equal to the rotation frequency of the initial information signal position (3b) of the unlaminated disc (3) (N2) (N1 = N2), and the playback of the second plane of the optical disc (1) can be initialized as soon as the playback of the first plane of the same becomes completed.

In other words, as can be inferred from the demonstrational diagram shown in Figure 3, in a case where the first plane (side 1) of the optical disc (1) is initially played back sequentially from inner toward outer circumferences thereof, the rotation frequency of the inner circumferential side is controlled at 1,800 rpm, whereas the corresponding value on the outer circumferential side is controlled at 600 rpm. Upon the completion of the playback of the first plane, the initial information signal track position (3b) on the second plane of the optical disc (1) is located on the outer circumference, and accordingly, since the rotating direction & rotation frequency are identical respectively to the corresponding attributes of the final information signal position (2b) of the first plane, uninterrupted & continuous playback actions become possible.

Next, the optical disc playback device for continuously playing back both planes will be explained with reference to Figure 2.

In Figure 2, the optical disc (1) is mobilized to a specified position of the optical disc playback device (100) by a loading mechanism (not shown in the figure); in other words, it is positioned above the turntable (12) of the disc drive unit (10) by the center adaptor (13) and then fixed & retained by the clamper (14). Incidentally, a state where the unlaminated disc (2) constituting the first plane (side 1) of the optical disc (1) abides as the lower member hereby prevails.

In a case where a specified action (e.g., play action, etc.) becomes invoked, via the operation button of the optical disc playback device (100) or a remote control unit, etc., by a user, the action mode signal (60) becomes inputted into the system control unit (50), whereas the disc motor drive circuit (51) becomes activated by the control signal (61) issued from the system control unit (50), whereas the disc motor (11) of the disc drive unit (10) is rotated & driven by the drive signal (62), whereas the detection signal (63) obtained from the rotation frequency detection unit (15) {e.g., FG

(frequency generator), etc.} designed to detect the rotation frequency of said disc motor (11) is inputted into the disc motor drive circuit (51), whereas the disc motor (11), namely the optical /5 disc (1), is rotated at a specified rotation frequency based on a feedback control.

The laser drive circuit (52), furthermore, is activated by the control signal (64) issued from the system control unit (50), whereas the respective lasers of the first & second optical heads (20) & (30) orchestrated respectively on the upper & lower planes (first & second planes) of the optical disc (1) are turned ON by the laser drive signal (65) issued from the laser drive circuit (52).

Moreover, the focus tracking control circuit (53) is activated by the control signal (66) issued from the system control unit (50), whereas traditionally known focus tracking control actions of the respective objective lenses (21) & (31) of the first & second optical heads (20) & (30) are invoked by the control signals (67) & (68) issued from the focus tracking control circuit (53).

In a case where the specified focus tracking control actions are thus invoked, the beam spots (22) & (23) emitted respectively from the first & second optical heads (20) & (30) become optimally irradiated onto the respective information signal track units (2a) & (3a) of the unlaminated discs (2) & (3) of the optical disc (1), as a result of which the detection signals (69) & (70) originating respectively from the information signal track units (2a) & (3a) become outputted respectively from the first & second optical heads (20) & (30).

Next, the detection signals (69) & (70) are inputted into the detection signal processing circuit (54) and then partially inputted, as the focus tracking error signals (71) & (72), into the focus tracking control circuit (53) once again, based on which the above-mentioned feedback control actions accommodating plane vibrations, eccentric deviations, etc. resulting from the rotating & driving actions of the optical disc (1) can be invoked.

The signals (74) & (75) obtained from the detection signal processing circuit (54), on the other hand, are inputted into the switch circuit (55), whereas a desired playback plane (either first or second plane) is played back under the control of the control signal (73) issued from the system

control unit (50), whereas the specified signal (76) alone is outputted and then inputted into the playback signal processing circuit (56).

Of the output signals obtained from this playback signal processing circuit (56), the video & sound playback actions on a TV monitor, etc. are enabled by the signal (79) for video & sound, etc., whereas, on the other hand, the signal (77) is inputted into the address information processing circuit (57) and then inputted, as the signal (78) serving as a side signal (side 1/side 2 signal), etc., into the system control unit (50) together with an address signal.

Incidentally, in a case where [sic: No subject] becomes inputted into the optical disc (1) (CLV disc) control unit (50) for the of the present invention shown in Figure 1, control actions suitable for the CLV disc (rotation frequency control shown in Figure 3) are invoked by the disc motor drive circuit (51) under the pervasion of the control signal (61) issued from the system control unit (50).

At the same time, furthermore, the laser drive circuit (52) & focus tracking control circuit (53) are activated by the system control unit (50), whereas the first & second optical heads (20) & (30) are controlled based on traditionally known focus tracking control procedures in such a way that the beam spot (22) of the optical head (20) will become optimally irradiated onto the first plane of the optical disc (1), namely the information signal track unit (2a) of the unlaminated disc (2), and that the beam spot (32) of the optical head (30) will become likewise irradiated onto the second plane of the optical disc (1), namely the information signal track unit (3a) of the unlaminated disc (3), and subsequently, the information signals of the respective information signal track units (2a) & (3b) are detected and then inputted into the detection signal processing circuit (54). Moreover, the detection signals (74) & (75) obtained respectively from the first & second optical heads (20) & (30) are inputted into the switch circuit (55), whereas since the detection signal (76) corresponding to the specified playback plane alone is outputted from the system control unit (50), the signal (74) detected by the optical pickup (20) is, during the playback of the first plane, inputted, as the signal (76), into the playback signal processing circuit (56) for invoking desired playback actions. In a

case where the final information signal track (2b) of the first plane of the optical disc (1) is then played back by the optical pickup (20), a lead-out signal becomes detected, whereas the system control unit (50) proceeds, upon the detection of said signal, to switch the prevailing state for outputting the signal (74) of the optical pickup (20) to a state for outputting the detection signal (75) of the wire harness (30) by controlling the switch circuit (55) with the control signal (73). As a result, the final information signal on the first plane and the initial information signal on the second plane can be continuously played back.

It goes without saying that traditionally used LDs can be played back by the optical pickup (20) according to procedures similar to conventional procedures. /6

(Effects of the invention)

As has been mentioned above, as far as the morphologies of the information signal recording formats for the respective unlaminated discs constituting the optical disc of the present invention are concerned, a counterclockwise spiral track morphology from inner toward outer circumferences thereof may, for example, be orchestrated on the first plane of the optical disc (plane corresponding to side 1), whereas a clockwise spiral track morphology from outer toward inner circumferences thereof is orchestrated on the second plane of the optical disc (plane corresponding to side 2), whereas an optical disc playback device is provided by orchestrating mutually independent optical heads on both planes of the aforementioned optical disc, according to which the respective rotation frequencies of the final information track position on the first plane and the initial information track position on the second plane become identical even in the case of a CLV disc, and since a playback switch action from first to second planes can be instantaneously invoked, it becomes possible to play back both planes continuously without entailing a time loss. It therefore becomes possible to provide an optical disc and an optical disc playback device with significantly improved functions & favorable user friendliness.

4. Brief explanation of the figures

Figures 1 are diagrams which show plane views of information signal track morphologies of the optical disc of an application example of the present invention, whereas Figure 2 is a block diagram which shows an optical disc playback device for playing back the optical disc shown in Figure 1, whereas Figure 3 is a demonstrational diagram provided for explaining the rotation frequencies of a case where both sides of the optical disc shown in Figure 1 are played back.

(1): Optical disc;

(2) & (3): Unlaminated discs;

(10): Disc drive unit;

(20): First optical head;

(30): Second optical head;

(50): System control unit;

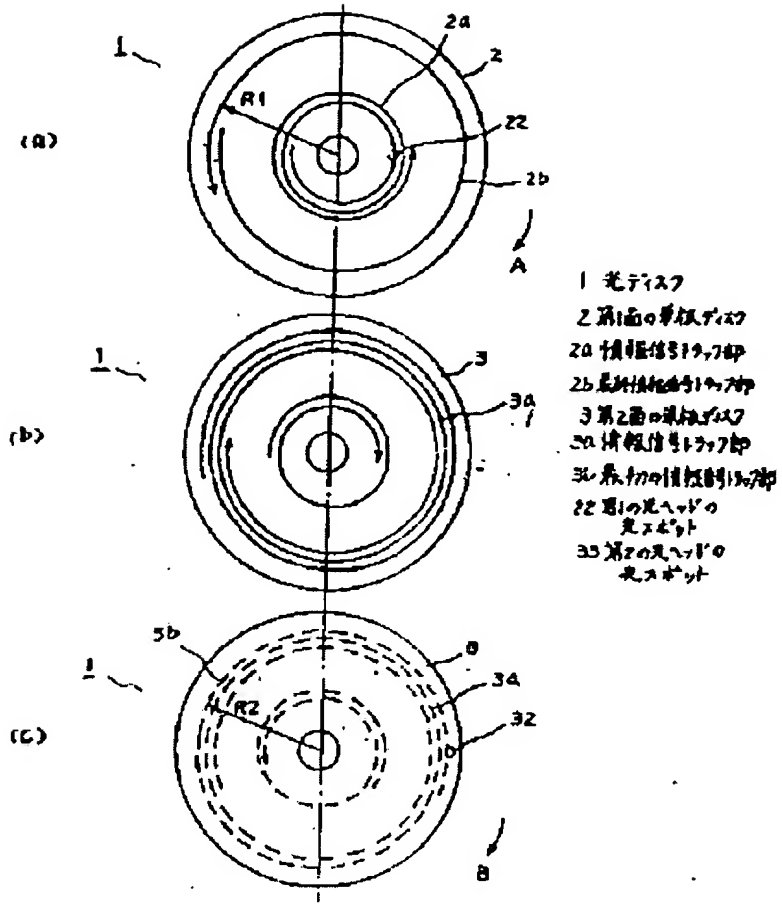
(55): Switch circuit;

(100): Optical disc playback device.

Agent: Katsuo Ogawa, patent attorney

Figures 1

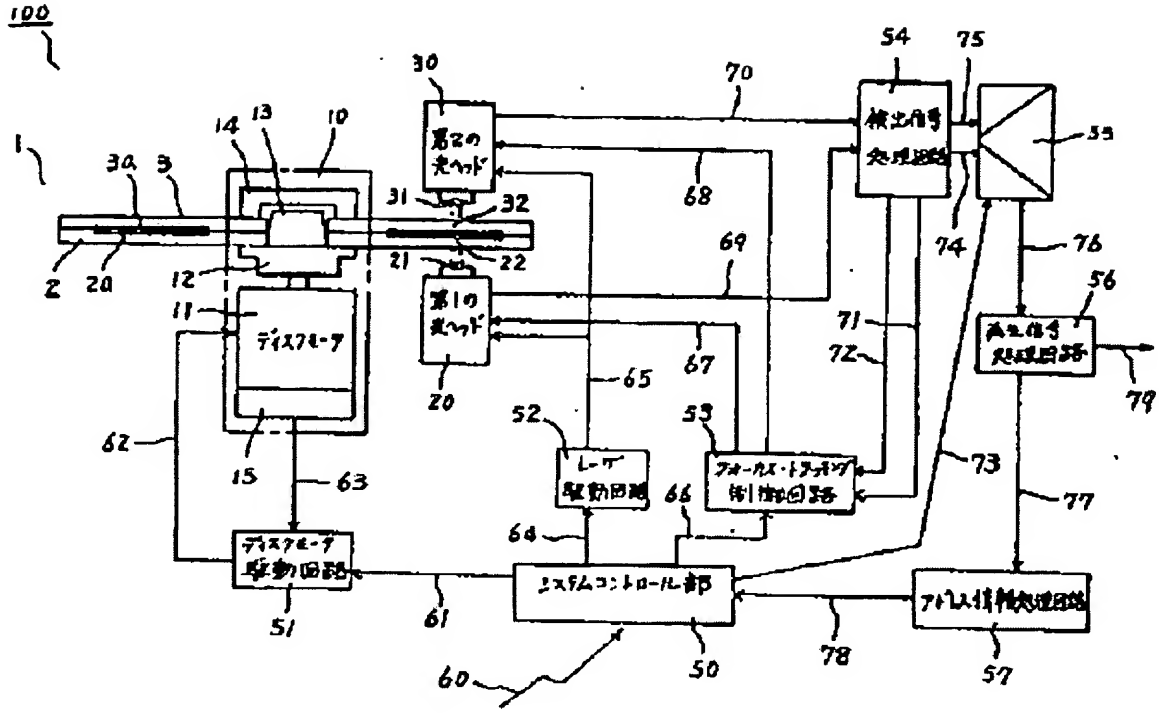
第 1 図



(a)

(b)

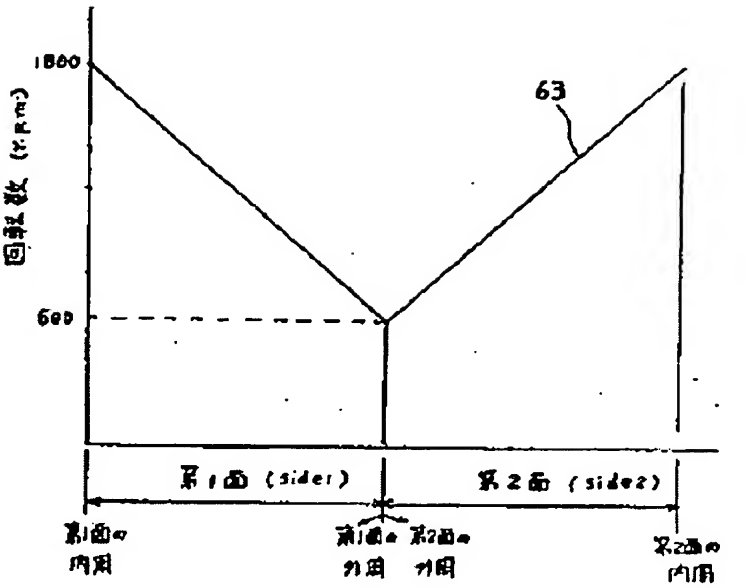
第 2 図



[(1): Optical disc; (2): Unlaminated disc for first plane; (2a): Information signal track unit; (2b): Final information signal track position; (3): Unlaminated disc; (3a): Information signal track unit; (3b): Initial information signal track position; (22): Beam spot for first optical head; (33) [sic: Presumably "(32)"]: Beam spot for second optical head]

Figure 3

第. 3 図



光ディスクの半径方向位置

[(1): Positions along radial direction of optical disc; (2): Rotation frequency; (3): First plane (side 1); (4): Second plane (side 2); (5): Inner circumference of first plane; (6): Outer circumference of first plane; (7): Outer circumference of second plane; (8): Inner circumference of second plane]

Figure 2

/7

(1): Optical disc; (10): Disc drive unit; (15): Disc motor; (20): First optical head; (30): Second optical head; (50): System control unit; (51): Disc motor drive circuit; (52): Laser drive circuit; (53): Focus tracking control circuit; (54): Detection signal processing circuit; (55): Switch circuit; (56): Playback signal processing circuit; (57): Address information processing circuit; (100): Optical disc playback device]

Procedural amendment form (spontaneously issued)

August 7, Sho 62[1987]

Dear Chief Judge of the Patent Agency:

Display of case:

Japanese Patent Application Tokugan No. Sho 62[1987]-101912

Title of the invention:

Optical disc and playback device for the same

Amending party:

Relation to the case: Patent Applicant

Name: (510) Hitachi, Ltd.

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Name: (6850): Katsuo Ogawa, patent attorney

Targets of amendments:

"Detailed explanation of the invention" section of the invention

Contents of amendments:

See the separately attached sheet

[END]

1. The "... this embodiment proposed under tension" mentioned in line 8, page 6 of the specification is amended as "... this embodiment proposed in the prior art."

2. The "... (CLV disc) ..." mentioned in line 7, page 17 of the specification is amended as "... where [the optical disc (1)] (CLV disc) is used, the action mode signal (60) becomes inputted into the system [control unit (50)] ..."

END